

Eco-Toxicology and Control of Indian Desert Gerbil, *Meriones hurrianae* (Jerdon)

V. Food preference in the Field during Monsoon

BY

ISHWAR PRAKASH

Animal Studies Division, Central Arid Zone Research Institute, Jodhpur

Food preference of the Indian Desert Gerbil, *Meriones hurrianae* (Jerdon) during monsoon is described by identifying the unconsumed plant species lying near their burrow openings and from field observations with binoculars. A comparison of the occurrence of unconsumed plant species with that in the surrounding plant communities revealed that the Desert Gerbils chiefly feed on grasses in the monsoon season. Economic losses by the Desert Gerbil are discussed.

INTRODUCTION

An earlier study of the stomach contents of the Indian Desert Gerbil, *Meriones hurrianae* (Jerdon) had revealed that normally their food consists of seeds but during the rainy season they thrive more on shoots, leaves and flowers of plants that are readily available (Prakash 1962). Only a few plant species could, however, be identified from the stomach contents since they were thoroughly masticated. Recently, during field observations, it was noticed that while consuming plants, the rodents leave identifiable portions near their burrow openings during the monsoon season, the main flowering season for herbs in the desert. This study is aimed at finding the preference for various herbs and to estimate their loss under field conditions.

METHODS

Plant remains were identified and the number occurring near each burrow opening was recorded. In one plant community observations were taken around 20 to 30 burrow openings. The composition of the vegetation was studied by line intercept method and frequency of occurrence of each species was compared with the frequency of occurrence of that species found unconsumed near gerbil burrow openings. If the latter

was more than twice its occurrence in the surrounding vegetational community, that species was regarded as 'most preferred'; if less than twice 'preferred', if less than its occurrence in the community but not less than 50 per cent 'less preferred', and if less than 50 per cent then 'not preferred'. Each of the above four palatability class was awarded the numerical scores of 4, 3, 2 and 1, respectively. To find out the palatability index of various food species the numerical scores denoting the various palatability classes were added for species occurring in more than two communities and an average was found out.

Observations were also made with a 10×40 binoculars on gerbils feeding on various identified plant species.

All these observations were made during the monsoon season at Maulasar in a fenced area of 72 hectares. This area lies in a tract with an average annual rainfall of 400 mm., in the Nagaur District of Western Rajasthan.

OBSERVATIONS AND DISCUSSION

I. Observations on unconsumed plant species lying near Desert Gerbil burrow openings

The observations were taken in four plant communities found in the area :

(a) *Cenchrus ciliaris*—*Cyperus arenarius*—*Eleusine compressa*—*Phaseolus trilobus* community

This community was situated on a low lying sandy plain and the species comprising this community had a frequency of 75 per cent in the transects. The other species in this community having a frequency of 50 per cent were *Justicia vahlii*, *Digitaria adscendens*, *Tephrosia purpurea*, and *Boerhavia diffusa*. *Cenchrus ciliaris*, although forming 14·0 per cent of the vegetation in this community, constituted 69·2 per cent of plant species found unconsumed near burrow openings (Table 1). It was the most preferred species. *Cyperus arenarius* and *Aristida adscensionis* although having a low per cent of incidence in nature (0·66 and 2·0 per cent only) yet formed 7·7 per cent of the gerbil food indicating a high preference for these. *Eleusine compressa* on the other hand formed 10·6 per cent of the community and formed only 7·7 per cent of the rodent diet. It is worth noting that the plant *Phaseolus triolobus* and those having 50 per cent frequency were completely absent from the gerbil menu indicating that they are unpalatable to gerbils. This may also be due to the higher availability of *Cenchrus ciliaris* which forms the majority of the gerbil food in this plant community. 92·2 per cent of the food species were grasses (Poaceae).

(b) *Digitaria adscendens*—*Perotis hordeiformis*—*Brachiaria ramosa*—*Eragrostis ciliaris* community.

The community was found on a stabilised sand dune. The four species forming this community had a frequency of 83.3 per cent and the

TABLE 1

PER CENT OCCURRENCE OF UNCONSUMED PLANT SPECIES NEAR GERBIL BURROW OPENINGS AND IN NATURE, AND THEIR PALATABILITY CLASSES IN THE PLANT COMMUNITY(a)

Plant species	Per cent occurrence		Palatability classes
	Unconsumed plant species near burrow openings	in nature	
<i>Cenchrus ciliaris</i>	69.2	14.0	most preferred
<i>Eleusine compressa</i>	7.7	10.6	less preferred
<i>Aristida adscensionis</i>	7.7	2.0	most preferred
<i>Cyperus arenarius</i>	7.7	0.66	most preferred
<i>Digitaria adscendens</i>	3.8	2.6	preferred
<i>Eragrostis ciliaris</i>	3.8	0.66	most preferred

others having a frequency of 66.6 per cent were : *Tribulus terrestris* and *Justicia vahlii* ; and those having a frequency of 50 per cent were : *Cyperus*

TABLE 2

PER CENT OCCURRENCE OF UNCONSUMED PLANT SPECIES NEAR GERBIL BURROW OPENINGS AND IN NATURE, AND THEIR PALATABILITY CLASSES IN THE PLANT COMMUNITY(b)

Plant species	Per cent occurrence		Palatability classes
	Unconsumed plant species near burrow openings	in nature	
<i>Digitaria adscendens</i>	21.3	17.3	less preferred
<i>Cenchrus ciliaris</i>	18.6	1.8	most preferred
<i>Brachiaria ramosa</i>	8.0	9.5	less preferred
<i>Eragrostis ciliaris</i>	8.0	6.5	preferred
<i>Aristida adscensionis</i>	8.0	6.0	preferred
<i>Dactyloctenium aegyptium</i>	8.0	3.5	most preferred
<i>Eragrostis cilianensis</i>	6.6	1.8	most preferred
<i>Cenchrus biflorus</i>	5.3	0.6	most preferred
<i>Tribulus terrestris</i>	2.6	12.0	not preferred
<i>Tragus biflorus</i>	2.6	3.0	less preferred
<i>Glinus hirta</i>	2.6	1.8	preferred
<i>Cucumis callosus</i>	2.6	0.6	most preferred
<i>Perotis hordeiformis</i>	1.3	10.7	not preferred
<i>Cyperus arenarius</i>	1.3	3.0	not preferred
<i>Boerhavia diffusa</i>	1.3	0.6	most preferred
<i>Cenchrus setigerus</i>	1.3	0.6	most preferred

arenarius, *Heliotropium marifolium*, *Cenchrus biflorus*, *Tragus racemosus*, *Aristida adscensionis* and *Corchorus* sp. In this community *Cenchrus ciliaris* in spite of having a low (1.8 per cent) occurrence in nature constituted 18.6 per cent of the food species, while *Digitaria adscendens*, which had the maximum occurrence of 17.3 per cent in nature, constituted 21.3 per cent of the rodent menu (Table 2), showing that the former species is more preferred. On the other hand, the occurrence of *Tribulus terrestris* was 12.0 per cent in nature and it constituted only 2.6 per cent of gerbil food. *Brachiaria ramosa* and *Perotis hordeiformis* having higher frequency were rated as less preferred and not preferred, although their occurrence percentages were 9.5 and 10.7 respectively. Some of the species having higher frequency of occurrence in the community were not eaten. 89.0 per cent of the gerbil food in this community comprised of grasses.

(c) *Cyperus arenarius*—*Digitaria adscendens*—*Pulicaria wightiana*—*Justicia vahlii* community.

The plant community occurred on an inter-dune sandy plain. The first two species in this community had 100 per cent frequency in the transects, and the latter two had 83.3 per cent frequency. *Eragrostis cilianensis* and *Tragus biflorus* had a frequency of 66.6 per cent. In this community *Cenchrus ciliaris* formed 25.5 per cent and *Eragrostis cilianensis* 8.5 per cent of the gerbil food in spite of being only 4 and 0.5

TABLE 3

PER CENT OCCURRENCE OF UNCONSUMED PLANT SPECIES NEAR GERBIL BURROW OPENINGS AND IN NATURE, AND THEIR PALATABILITY CLASSES IN THE PLANT COMMUNITY(C)

Plant species	Per cent occurrence		Palatability classes
	Unconsumed plant species near burrow openings	in nature	
<i>Cenchrus ciliaris</i>	25.5	4.0	most preferred
<i>Cyperus arenarius</i>	17.0	24.5	less preferred
<i>Digitaria adscendens</i>	8.5	14.0	less preferred
<i>Aristida adscensionis</i>	8.5	2.0	most preferred
<i>Eragrostis cilianensis</i>	8.5	0.5	most preferred
<i>Cynodon dactylon</i>	6.3	2.0	most preferred
<i>Polycarpha corymbosa</i>	6.3	1.5	most preferred
<i>Eragrostis ciliaris</i>	4.2	4.5	less preferred
<i>Tragus biflorus</i>	4.2	4.5	less preferred
<i>Eleusine compressa</i>	4.2	0.5	most preferred
<i>Trichodesma indica</i>	2.1	2.5	less preferred

per cent respectively in nature (Table 3), indicating that they are most preferred by the desert gerbils. *Cyperus arenarius* and *Digitaria adscen-*

dens have a higher occurrence (24.5 and 14.0 per cent respectively) in nature as compared to that in the gerbil food (17.0 and 8.5 per cent respectively) and both the species are rated as 'less preferred'. *Pulicaria wightiana* and *Justicia vahlii*, though predominantly occurring in nature, did not at all occur as gerbil food. In this community, grasses formed 73.1 per cent of the gerbil food.

(d) *Pulicaria wightiana*—*Justicia vahlii*—*Polycarpaea corymbosa*—*Sporobolus helvolus* community.

This community was situated on the flat top of a sand dune. All the four species forming the community had 100 per cent frequency in the transects. *Aristida adscensionis* and *Convolvulus microphyllus* had 75 per cent frequency. All the dominant species of the community were absent from the gerbil food except a low (4.5 per cent) occurrence of *Sporobolus helvolus* as against 17.5 per cent (Table 4) incidence in nature which shows that the species was not preferred by gerbils. *Cenchrus ciliaris*, the occurrence of which is maximum in the gerbil food, was absent in this community and the desert gerbil showed lesser selectivity

TABLE 4

PER CENT OCCURRENCE OF UNCONSUMED PLANT SPECIES NEAR THE BURROW OPENINGS AND IN NATURE, AND THEIR PALATABILITY CLASSES IN THE PLANT COMMUNITY(d)

Plant species	Per cent occurrence		Palatability classes
	Unconsumed plant species near burrow openings	in nature	
<i>Brachiaria ramosa</i>	22.7	4.0	most preferred
<i>Perotis hordeiformis</i>	13.5	4.0	most preferred
<i>Cenchrus biflorus</i>	9.0	4.0	most preferred
<i>Aristida adscensionis</i>	9.0	3.2	most preferred
<i>Convolvulus microphyllus</i>	9.0	2.4	most preferred
<i>Sporobolus helvolus</i>	4.5	17.6	not preferred
<i>Fimbristylis barbata</i>	4.5	3.2	preferred
<i>Digitaria adscendens</i>	4.5	0.8	most preferred
<i>Boerhavia diffusa</i>	4.5	0.8	most preferred
<i>Glinus hirta</i>	4.5	0.8	most preferred
<i>Tragus biflorus</i>	4.5	0.8	most preferred

in preferring various food species when compared to other communities in which it was present. *Perotis hordeiformis*, rated not preferred in community (b) was rated as most preferred. Moreover, all the species except *Sporobolus helvolus* and *Fimbristylis barbata* were rated as most preferred. It appears, therefore, that in the presence of the choicest species, the rodents do not show selectivity in choosing their food. In this community 89.0 per cent food comprised of various species of grasses,

II. Palatability Index of various plant species

Table 5 shows that out of the seven species which occurred as food item in more than two communities, the first six belong to family Poaceae which indicates that the Indian Desert Gerbil, *Meriones hurrianae*

TABLE 5

PALATABILITY INDEX OF UNCONSUMED PLANT SPECIES OCCURRING IN MORE THAN TWO COMMUNITIES, AS RATED BY DESERT GERBILS

Plant species	Family	No. of communities in which occurred	Palatability Index
<i>Cenchrus ciliaris</i>	Poaceae	3	4.0
<i>Aristida adscensionis</i>	Poaceae	4	3.7
<i>Eragrostis ciliaris</i>	Poaceae	4	3.0
<i>Digitaria adscendens</i>	Poaceae	4	2.7
<i>Brachiaria ramosa</i>	Poaceae	3	2.6
<i>Tragus biflorus</i>	Poaceae	3	2.6
<i>Cyperus arenarius</i>	Cyperaceae	3	2.3

mainly feeds on grasses. *Cyperus arenarius* (Cyperaceae) was the only non-grass species to occur in this hierarchy of preference but it is rated lowest as compared to other six grasses. All these grasses are palatable to livestock.

III. Field observations on Desert Gerbil food

Observations with binoculars revealed that the gerbils fed mostly on shoots, leaves and inflorescence of plants. In an earlier study (Prakash 1962) on the examination of stomach contents it was found that during monsoon season the occurrence of these plant parts increased whereas in other seasons, seeds formed their main food. The following plant species were observed being consumed by the gerbil.

Family POACEAE

1. *Cenchrus ciliaris*
2. *Cenchrus setigerus*
3. *Cenchrus biflorus*
4. *Aristida adscensionis*
5. *Digitaria adscendens*
6. *Eleusine compressa*
7. *Cynodon dactylon*
8. *Eragrostis ciliaris*
9. *Eragrostis cilianensis*

10. *Dactyloctenium aegyptium*
11. *Brachiaria ramosa*
12. *Perotis hordeiformis*
13. *Tragus biflorus*

Family CARYOPHYLLACEAE

14. *Polycarpaea corymbosa*

Family CYPERACEAE

15. *Cyperus arenarius*

Family ZYGOPHYLLACEAE

16. *Tribulus terrestris*

Family MOLLUGINACEAE

17. *Glinus hirta*

Family CUCURBITACEAE

18. *Cucumis callosus*
19. *Citrullus colocynthis*

Family NYCTAGINACEAE

20. *Boerhavia diffusa*

Family CONVULVULACEAE

21. *Convolvulus microphyllus*

Out of 21 species eaten by the Desert Gerbil, 13 were grass species and most of the plants observed being fed on by the gerbil are those which were found unconsumed near gerbil burrow openings. Thus, besides consumption there is also perhaps a larger amount of destruction through the cut and unconsumed material.

IV. Economic consideration

In the desert tract, where the study was conducted, the density of Desert Gerbil was estimated to be 477 per hectare. Considering that a gerbil consumes about 6 gm. feed per day (Prakash & Kumbkarni 1962), their annual requirement will be 1044 kg./hectare¹; assuming that their number will be maintained at this level all the year round.

¹ The cost of this fodder will be about Rs. 225.68 per hectare at the rate of Rs. 20.00 per quintal.

The figures of the estimated forage production in this tract during 1963-64 and 1964-65 are summarised in Table 6 (Ahuja, Personal communication). Comparing the gerbil depredation and forage production figures, it will be observed that hardly any fodder will be left for

TABLE 6
FORAGE PRODUCTION (AIR DRIED) PER HECTARE AT MAULASAR

Forage species	Forage production (air dried) per hectare, kg.	
	1963-64	1964-65
1. Edible grasses ; High perennials (<i>Cenchrus</i> spp.)	332	196
Low perennials (<i>Eleusine compressa</i> , <i>Cynodon dactylon</i> , etc.)	31	8
<i>Cyperus</i> spp.	25	8
Annuals (<i>Aristida</i> spp., <i>Cenchrus biflorus</i> , <i>Digitaria adscendens</i> , <i>Tragus biflorus</i> etc.)	822	307
Total edible species	1210	519
2. Non-edible species	159	315
Total forage production	1369	834

livestock, particularly when the estimate of the gerbil consumption does not include the destruction they do merely by cutting the grasses to reach the inflorescence. The rodents also destroy the vegetation by damaging their roots by tunnelling and expose the loose soil excavated from these tunnels to wind, thus affecting grass growth. All these factors in their turn affect the establishment of good pastures for proper livestock industry which largely depends on these pastures. It is, therefore, essential that control operations are to be visualised while planning improvements to rangelands.

ACKNOWLEDGEMENTS

Thanks are due to Dr. P. C. Raheja, Director (Retd.) and to Shri C. P. Bhimaya, Director, Central Arid Zone Research Institute, for providing facilities, for encouragement and helpful suggestions ; to Shri K. C. Kanodia, Systematic Botanist, for identifying most of the plant species ; to Shri L. D. Ajuha, Livestock Officer, for providing the

data on forage production ; and to Sarvashri Bajrang Lal Sain and Hari Prasad Sharma for assistance during the field work.

REFERENCES

- PRAKASH, I. (1962) : Ecology of gerbilles of the Rajasthan desert, India. *Mammalia* 26 : 311-331.
- , & KUMBKARNI, G. C. (1962) : Eco-toxicology and control of Indian desert gerbille, *Meriones hurrianae* (Jerdon). I. Feeding behaviour, energy requirement and selection of bait. *J. Bombay nat. Hist. Soc.* 59 : 800-806.